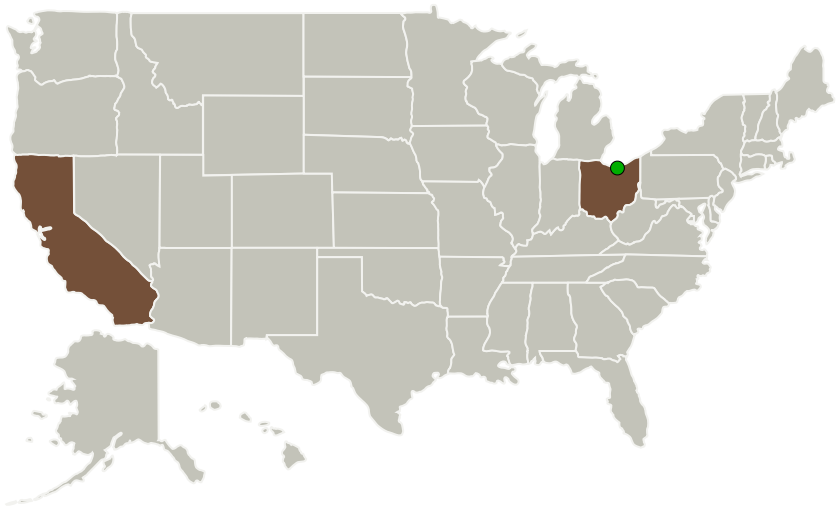
Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I

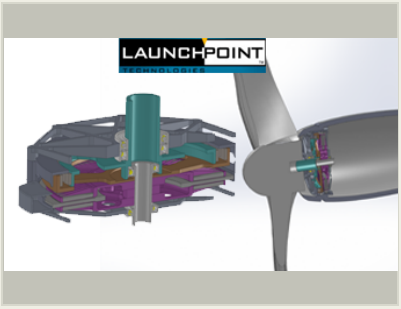
Completed Technology Project (2015 - 2015)

Project Introduction

Electric propulsion has the potential to revolutionize aircraft design and architecture. A distributed electric propulsion system for a VTOL aircraft can exploit aerodynamic benefits increasing the lift to drag ratio by 4 to 5 times (Fredericks et al, Intl Powered Lift Conf, Aug 2013) to that of conventional rotorcrafts. Basic physics principles can demonstrate that weight and efficiency optimized electric motors and propellers of the same power rating will rotate at different rpm making a transmission system/gearbox desirable. High speed electric motors have excellent specific power whereas low speed propellers are more efficient. In distributed propulsion systems there may be numerous individual propulsors making gearbox maintenance a significant effort that will detract from the potential cost savings of electric propulsion. We propose a magnetic transmission (magnetic gearbox) design that will allow optimal matching of high specific power electric motors to efficient propellers for use on electric or hybrid-electric air vehicles. The proposed magnetic transmission will have a mass of no more than an equivalent rated mechanical gearbox. Unlike conventional gears the magnetic transmission will have no lubrication requirements, gear tooth wear, will be immune to vibration fatigue in the gear teeth, and will have minimal acoustic noise. If overloaded the design will benignly "slip a tooth" and then re-engage. We propose to design, build and test a magnetic transmission optimized for specific torque, and compare the weight of the system to an optimal mechanical gearbox of the same power. We will also perform design studies to show how a magnetic gearbox could scale up to a helicopter main rotor gearbox.

Primary U.S. Work Locations and Key Partners





Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I

Table of Contents

Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I

Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
LaunchPoint Technologies, Inc.	Lead Organization	Industry	Goleta, California
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
California	Ohio

Project Transitions

June 2015: Project Start

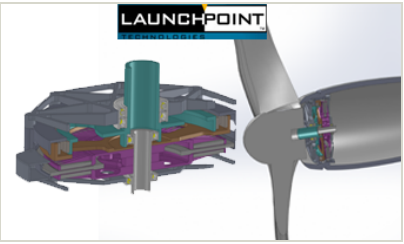
December 2015: Closed out

Closeout Summary: Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139285)*

Images



Briefing Chart Image
Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I
(https://techport.nasa.gov/image/136934)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
LaunchPoint Technologies, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

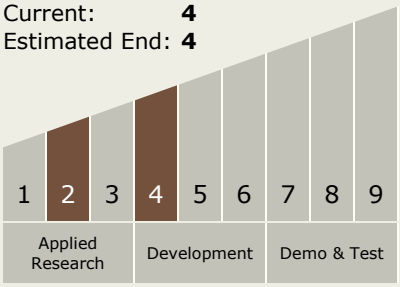
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Dave Paden

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Non-Contact Magnetic Transmission For Hybrid/Electric Rotorcraft, Phase I

Completed Technology Project (2015 - 2015)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.3 Mechanical Systems
    - TX12.3.2 Electro-Mechanical, Mechanical, and Micromechanisms

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System